Panel: Software Requirements Engineering Education in a Changing world

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***Abstract*—One of the biggest challenges of organizations in contemporary times is the ability to manage rapid changes in business environment. Software and expert information systems can help to manage changes and thus contribute to addressing this challenge. The initial, and perhaps, most important activities in software and expert systems development are to elicit, analyze, specify, and validate requirements. The methods, processes, tools, and techniques for performing these activities is called 'Requirements Engineering' (RE). The aim of this panel is to bring together RE academics, practitioners, and researchers to discuss innovative ways of educating and training RE professionals that would develop software and information systems to address rapid changes in business environment. Additionally, this panel intends to identify and examine various challenges of RE education in our changing world, and proffer possible strategies to address them. We hope that the discussions from this panel will inform RE and REE practice.**

I. Description and Rationale

Requirements Engineering (RE) is an important part of the Software Engineering (SE), Information Systems (IS), or Computer Science (CS) Curriculum, taught at both undergraduate and graduate levels. A typical RE course helps students to learn the processes, methods and tools for identifying, eliciting, analyzing, specifying and validating the requirements of software products [1]. The term requirements refer to the description of the functions, behaviors, features, constraints, and quality attributes that should be implemented in a software product [2, 3]. RE is an important aspect of software development and critical to the overall success of a software [4] such that there is a correlation between bad requirements and software failures.

There is a very high demands of RE professionals to work in industries as requirements engineers or analysts, business analysts, enterprise analysts, and so on [5]. Requirements engineering education (REE) and training programs are intended to produced qualified RE professionals to meet industry demands. At the same time, rapid and unpredictable changes, due to factors such as technology update and obsolescence, changing business needs, and regulatory compliance [6, 7, 8] require innovative approaches to delivering REE curriculum as well as REE course design.

There are concerns that, over time, the traditional approach of requirements engineering practice and education may no longer be adequate to develope innovative and agile software and IS that can meet contemporary industry needs. Hence the need to re-evaluate and re-position requirements engineering education in universities and colleges. Moreover, contemporary issues in RE/E such as diversity [9], as well as application of gamification, virtual reality and open source software to REE [10, 11, 12] are yet to be fully explored. Furthermore, Uskov et al [5] report of shortage of skills in RE and business analysis. Taken together, these challenges can threaten the viability of REE.

II. Goal of the Panel Session

The goal of this panel is to develop innovative approaches that can address the challenges, current issues, and future trends in requirements engineering education. Specifically, we will focus on problems, prospects, technologies, and instructional methods in requirements engineering education. Participants will also have the opportunity to share and learn how RE education can be re-positioned to meet contemporary industry and academic needs.

During the Panel, participants are expected to focus on three main areas of discussion, these are briefly described below.

Innovative Teaching Techniques in REE: This area of discussion includes brainstorming on the application of virtual reality (VR), augmented reality (AR), agile methodologies, and collaborative learning technologies to REE. Participants will also explore how open source tools and software, creativity and ideation, flipped pedagogy, and project based learning (PjBL) can applied to enhance teaching and learning of requirements engineering.

REE Curriculum and Industry Changes: The advent of artificial intelligence (AI), Big Data (BD), machine learning (ML), and cybernetics is increasingly demanding changes to the traditional approach of requirements engineering and software development. For REE to remain viable, it would be vital to redesign its curriculum to respond to these changes. This area of discussion will focus on REE course and curriculum redesign to meet industry changes and new industry software and information systems.

Challenges, Issues, and Prospects in REE: In this discussion area, participants are expected to identify and

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analyze the problems, limitations, and gaps in REE. The discussion will also include various strategies to close these gaps and solve the identified problems, including current and future trends in REE.

III. Anticipated Audience

The agenda and areas of discussion of this panel panel are designed to accommodate anyone with a keen interest in requirements engineering education. This should include industry practitioners, software developers as well as RE instructors, professors. More so, other practitioners and instructors in the broad discipline of Information Systems, Software Engineering, and Computer Science can also contribute and benefit from this panel. Other people, such as students, who want to learn more about requirements engineering education are also encouraged to attend and participate in this panel.

IV. Panel Agenda

A summary of the panel agenda is shown in Table I

TABLE I: Panel Agenda

Time (Minutes)	Activity
5	Introduction of Participants
15	**Presentation:** "Engineering Required Possibilities": By Dr. Stephen T. Frezza, PSEM. Dr. Frezza has over 18 years experience practice and teaching RE. See the presentation description in Section IV-A below
5	Q/A and Interactive discussions on the presentation
20	**Group Activity**: Discuss and Share. This discussion will focus on the 3 key areas described in Section II. There will 3 groups of between 3 to 5 participants per group. Each group will select and brainstorm on one area of discussion in Section II for about 20 minutes, and afterwards share/present their findings to other participants.
30 (10 per group)	**Group Presentation:** Each group will be given 10 minutes to present or share their findings from the group activity above
5	Closing remarks

A. Presentation Description by Dr. Frezza

One substantive issue that affects REE is the role of creativity and ideation in the development of requirements. Traditional requirements techniques give undue focus on The Problem, or that which is wrong in the environment in which some new system will be introduced; The focus is on what the phenomena are that need to interact with the environment in order to meet the needs as perceived. While these foundations allow for creativity and idea generation, the emphasis is usually on fixing things that are broken. This is compounded by the fact that many engineers self-identify as problem solvers, who are there to discover the problems and then fix them. Overcoming this attitude to help students learn to creatively seek out the real needs can be difficult.

One solution to this difficulty is to focus students away from traditional problem solving approaches, and refocus their skill and value sets on discovering the real value needed by stakeholders, rather than just their problems. To help RE professionals realize that their fundamental role is to help find Mjligheter: the practical, actionable possibilities that maximize the value-add that a technical solution brings to the environment in which it will be introduced. This requires developing skills to utilize creativity and work with Ill-Structured Problems, and professional values to seek out value in the stockholders context, not just listen for solvable problems. Engineering the required possibilities.

V. Accepted Peer-Reviewed Full Papers Relating to the Panel

The organizers of this panel are authors and or co-authors in 2 peer-reviewed full papers accepted in FIE. These are listed and briefly discussed in Section V-A and V-B below.

A. Cross-Course Project-based Learning in Requirements Engineering: An Eight-year retrospective.

This paper presents a study of eight years of cross-course project-based learning (CC-PjBL) in an upper-level requirements and project management (RPM) course. Project- based learning (PjBL) is a method of instruction in which students learn by investigating and solving real-world problems in and open-ended, time-limited context.

Our instantiation of CC-PjBL matched paired students in an introductory software Requirements and Project Management (RPM) with students in different technology- oriented software development course(s) to utilize the requirements deliverables created by their RPM- course colleagues. The paper includes a review of relevant related PjBL literature, descriptions of our initiative and experience in applying CC-PjBL to RPM topics over eight years, and the lessons learned thereof.

This paper reports summary experiences from student evaluations of these courses to evaluate the CC- PjBL experiences. The discussion also includes problems encountered with CC-PjBL assessment, faculty participation, and course hand-off, which may be useful to instructors that are considering to apply CC-PjBL as a method of instruction and to those that are currently practicing PjBL.

B. The Impact of Learning Styles on Student Performance in Flipped Pedagogy

Flipped classroom is an emerging pedagogical model with potentials to support active engagement and improve student performance. This research empirically validate the impact of: 1) Flipped classroom on student performance; and 2) Preferred learning style on student performance in a flipped classroom. We designed an experiment to compare the performance of students in flipped classroom with traditional teaching method.

This experiment involves a total of 35 students. The students were divided into two separate classes (01 and 1E) taught by the same professor with the same contents and assessment methods. Students in Class 01 are the experiment group and were taught with flipped method, while students in Class 1E are the control group and were taught with traditional method. Data was collected from three components of student assessment (Participation, Homework, and Exam) and questionnaire;

we used the questionnaire to group students by their preferred learning styles.

The key findings after data analysis include a) Students in flipped classroom achieved 7% higher Participation Grade than their peers in traditional. b) Students in traditional classroom achieved 17% higher Homework Grade and 6% higher Exam Grade than their peers in flipped classroom. c) Logical Learners outperformed Visual Learners by 10% in flipped classroom. Further, we discussed the implications of these findings to practice. We expect this paper to be useful and informative to higher education instructors who adopt or plan to adopt flipped classroom in their courses.

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